

REMARKS

Claims 16-19 were previously pending in the application. New claims 20-22 are added. Therefore, claims 16-22 are presented for consideration.

Claims 16-19 are rejected as unpatentable over CHAN et al. 6,468,906 in view of KITCH 6,140,238 and further in view of YAKURA 6,228,767.

Reconsideration and withdrawal of the rejection are respectfully requested because the references do not teach or suggest a first interconnect through a first insulating film and directly contacting a substrate. The references also fail to teach or suggest a first diffusion barrier layer film directly on a first insulating film and second diffusion barrier layer film directly on the first diffusion barrier film, a second insulating film directly on the second diffusion barrier film and a second interconnect through the first and second diffusion barrier films and the second insulating film as recited in claim 16 of the present application.

By way of example, Figure 2K of the present application shows a first interconnect 12. Interconnect 12 has metal barrier layers on the walls and bottom of a trench. This metal barrier layer of the interconnect directly contacts the substrate 4.

In addition, Figure 2K of the present application also shows a first diffusion barrier film 16 directly on a first

insulating film 6, a second diffusion barrier film 18 directly on the first diffusion barrier film 16, a second insulating film 20 directly on the second diffusion barrier film 18 and a second interconnect 32 through the first and second diffusion barrier films and the second insulating film. As seen in Figure 2K, the interconnect 32 including metal barrier layer 11 is through each of the barrier films 16 and 18 and through insulating film 20.

The Official Action offers CHAN et al. as teaching all that is recited except for the diffusion barrier layer and the insulating film layer in the required manner. However, CHAN et al. do not teach that for which it is offered. Specifically, as seen in Figure 4C of CHAN et al., the first interconnect 16A, 14A is not directly contacting a substrate.

It appears that both KITCH and YAKURA fail to overcome this shortcoming. Specifically, KITCH has a first dielectric layer 10 overlying a substrate (that is not shown) as disclosed at column 3, lines 47-49. The interconnect 12, 14 is contacting the dielectric layer 10, not a substrate.

As seen in Figure 1B of YAKURA, the substrate 2 has an insulating layer 4 thereon. However, copper oxide layer 10 which is through insulating layer 10 contacts copper layer 3 and not the substrate 2. The proposed combination of references does not teach a substrate with a first insulating film directly on the substrate and a first interconnect through the first insulating

film and directly contacting the substrate as recited in claim 16 of the present application.

KITCH is offered for the teaching of a diffusion barrier layer and an insulating film in the required manner. Applicants are unsure as to the position set forth in the Official Action. Specifically, claim 16 of the present application recites a first diffusion barrier film directly on an insulating film and second diffusion barrier film directly on the first diffusion barrier film and then a second insulating film directly on the second diffusion barrier film. KITCH teaches a single diffusion barrier 22 over dielectric layer 10. Further clarification of the elements of KITCH that are believed to read on the recited elements of claim 16 is respectfully requested.

YAKURA is cited for the teaching of an insulating film layer in the required manner. YAKURA teaches with respect to Figure 2D an insulating film on a first barrier layer, a second barrier layer on the insulating film and then a second insulating film on the second barrier layer. However, the second barrier layers are not directly contacting each other and the first insulating film of YAKURA is not directly on the substrate as recited in claim 16 of the present application. Further clarification of exactly which elements of YAKURA are believed to read on claim 16 of the present application is respectfully requested.

The above-noted features are missing from each of the references, are absent from the combination and thus are not obvious to one having ordinary skill in the art. Accordingly, claim 16 is believed patentable over the cited prior art.

Claims 17-19 depend from claim 16 and further define the invention and are also believed patentable over the cited prior art. In addition, the dependent claims include features not taught by the proposed combination of references. Specifically, claim 19 provides that the bottom of the second interconnect contacts walls of the first interconnect. As seen in Figure 2K of the present application, film 11 of the second interconnect is contacting the walls of the film of the first interconnect. None of the references disclose or suggest this feature and thus claim 19 is believed patentable regardless of the patentability of the claims from which it depends.

New claim 20 provides that the first and second diffusion barriers are different. As set forth on page 12, lines 3-10 of the present application, first insulating film 16 is an SiN layer and the second insulating film 18 is an SiC layer. New claim 21 provides that the first and second diffusion barrier films are the same and have different thicknesses. Page 9, lines 11-25 of the present application disclose that the first insulating film 16 is an SiN layer having a thickness of 20 nm

and the second insulating film 18 is an SiN layer having a thickness of 30 nm.

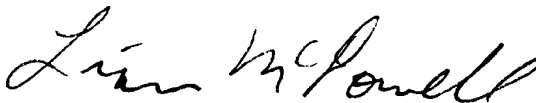
New claim 22 provides that the metal barrier layer on the walls of the first interconnect and the metal barrier layer on the walls of the second interconnect are aligned. As seen in Figure 2K of the present application, the walls of the first interconnect and the walls 11 of the second interconnect are aligned. None of these features is disclosed by the combination of references and thus these claims are also believed patentable over the cited prior art.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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